WHAT IS CLAIMED IS:

1.   A vertical black line removal system in a document scanner which includes a binarization system comprising:

a.   processing means that defines a difference value indicative of either a potential vertical black line defect or no vertical black line defect and defines a histogram value for each corresponding cross track sensor pixel;

b.   first storage means for storing each histogram value from the processing means wherein a cross track sensor pixel address for each pixel relates to a histogram value address;

c.   vertical black line search processing means which compares each stored histogram value with a predetermined threshold value to define a defect list of cross track sensor pixel addresses corresponding to a vertical black line defect; and

d.   output means operating only after the vertical black line search processing means has compared all stored histogram values to complete the defect list of addresses wherein the output means would output either a first normal binary image value or a second low contrast binary image value depending on whether a vertical black line defect exists at that particular pixel location.

2.   A vertical black line removal system operating after binarization in a bi-tonal image processing system of a document scanner, wherein the binarization creates a first normal contrast binary image value and creates a second low contrast binary image value, comprising:

a.   processing means which for each cross track sensor pixel defines a difference value indicative of either a potential vertical black line defect or no vertical black line defect and defines a histogram value equal to the sum of all the difference values for each corresponding cross track sensor pixel address;

b.   first storage means for storing the histogram value from the processing means wherein the cross track sensor pixel address for each pixel relates to each histogram value address;

c.   vertical black line search processing means which compares each stored histogram value with a predetermined threshold value to define a

defect list of those cross track sensor pixel addresses corresponding to a vertical black line defect;

        d.   second storage means for temporarily storing at least two of the first binary image value, the second binary image value, and the difference value; and

        e.   output means operating only after the vertical black line search processing means has compared all stored histogram values to complete the defect list of addresses wherein the output means compares each corresponding cross track sensor pixel address of the binary image values in the second storage means with each address in the defect list such that 1) when the compared addresses are not the same the first binary image value is output, and 2) when the compared addresses are equal and the difference value defines a potential vertical black line defect the second binary image value is output otherwise the first binary image value is output.

        3.   A vertical black line removal system for use after binarization in a bi-tonal image processing system of a document scanner, wherein the binarization performs processing of each cross track sensor pixel to create a first binary image value by employing a normal contrast setting and to create a second binary image value by employing a low-contrast setting, comprising:

        a.   processing means for creating a difference value indicative of either a potential vertical black line defect or no vertical black line defect for each cross track sensor pixel and a histogram value for each cross track sensor pixel equal to the sum of all the difference values;

        b.   first storage means for storing the histogram value from the processing means wherein the cross track sensor pixel address for each pixel relates to each histogram value address;

        c.   vertical black line search processing means for comparing each stored histogram value for each cross track sensor pixel address with a predetermined threshold value wherein the result of the comparison related to the cross track sensor pixel address for a vertical black line defect which is temporarily stored;

d.   second storage means for temporarily storing at least two of the first binary image value, the second binary image value, and the difference value; and

e.   output means which operates only after the vertical black line search processing means has compared all stored histogram values with the threshold value wherein the output means compares the cross track sensor pixel address for the binary image values in the second storage means with the cross track pixel sensor addresses for all vertical black line defects such that 1) when the compared addresses are not the same the first binary image value is output, and 2) when the compared addresses are equal and the difference value at that particular pixel in the second storage means defines a potential vertical black line defect the second binary image value is output otherwise the first binary image value is output.

4.   A vertical black line removal system for use after binarization in a bi-tonal image processing system of a document scanner, wherein the binarization performs processing of each cross track sensor pixel to create a first binary image value by employing a normal contrast setting and to create a second binary image value by employing a low-contrast setting, comprising:

a.   processing means for creating a histogram value and a difference value for each cross track sensor pixel by a comparing the first binary image value and the second binary image value wherein if the first binary image value is equal to the second binary image value then the difference value is zero, and if the first binary image value is not equal to the second binary image value then the difference value is one and the histogram value is sum of all the difference values;

b.   first storage means for storing each histogram value from the processing means employing the cross track sensor pixel address for each pixel to define each histogram value address;

c.   vertical black line search processing means for comparing each stored histogram value for each cross track sensor pixel address with a predetermined threshold value wherein when the histogram value is greater than

the threshold value the histogram value and cross track sensor pixel address for a vertical black line defect are stored;

        d.   second storage means for temporarily storing at least two of the first binary image value, the second image value, and the difference value; and

        e.   output means for comparing each cross track sensor pixel address in the second storage means with the cross track pixel sensor addresses for all stored vertical black line defects and which operates only after the vertical black line search processing means has completed the threshold value comparison for each histogram value wherein when the cross track sensor pixel address in the second storage means is not equal to the cross track sensor pixel address of a vertical black line defect then the first image value is output and when the cross track sensor pixel address in the second storage means is equal to the cross track sensor pixel address of a vertical black line defect then the difference value is evaluated such that when the difference value at that particular pixel is equal to one the second image value is output and when the difference value is equal to zero the first image value is output.

        5.   A vertical black line removal system as set forth in any one of claims 1-4, wherein an image deskewing means is located prior to the binarization and the system further comprises:

        a second processing means for creating for each deskewed image value a corrected cross track pixel sensor address which corresponds to the original cross track sensor pixel location of a scanned document; and

        wherein the corrected cross track pixel sensor address for each image value is employed by the search processing and output means.

        6.   A vertical black line removal system as set forth in any one of claims 1-4, wherein the vertical black line search processing means and processing means for creating a histogram value and difference value operate in parallel.

7.   A vertical black line removal system as set forth in any one of claims 1-4, wherein the first storage means comprises at least one SRAM.

8.   A vertical black line removal system as set forth in any one of claims 1-4, wherein the first storage means comprises one or two SRAMs wherein when two SRAMs are employed the histogram values are pixel-interleaved into each SRAM.

9.   A vertical black line removal system as set forth in any one of claims 2-4, wherein the second storage means comprises a DRAM.

10.   A vertical black line removal system as set forth in claim 9, wherein the second storage means comprises an SDRAM.

11.   A vertical black line removal system as set forth in claim 4, including content addressable memory means for storing each cross track sensor pixel address for a vertical black line correction resulting from the vertical black line search processing means.

12.   A vertical black line removal system as set forth in any one of claims 1-4, including an additional processing means for performing functions selected from the group consisting of multiple document page tracking, providing scanned document page parameters to the output means for generating the new cross track pixel sensor addresses, performing analysis of the histogram values and cross track sensor pixel addresses for a vertical black line defect resulting from the vertical black line search processing means to output scanner cleaning instructions, and combinations thereof.

13.   A method for performing vertical black line removal from a scanned document image after binarization of the image comprising the steps of:

    a.   creating for each cross track sensor pixel of the scanned image a difference value indicative of either a potential vertical black line defect or no vertical black line defect and a histogram value;

    b.   initially storing the histogram value wherein a cross track sensor pixel address for each cross track sensor pixel relates to each histogram value address;

    c.   performing a vertical black line search by comparing each stored histogram value with a predetermined threshold value to define a defect list of the cross track sensor pixel addresses corresponding to a vertical black line defect; and

    d.   after the vertical black line search has compared all stored histogram values, outputting either a first normal binary image value or a second low contrast binary image value depending on whether a vertical black line defect exists at a cross track sensor pixel address for each pixel.

    14.   A method for performing vertical black line removal from a scanned document image composed of cross track sensor pixels, after binarization of the image creates a first, normal contrast binary image value and a second, low contrast binary image value, comprising the steps of:

    a.   creating for each cross track sensor pixel of the scanned image a difference value indicative of either a potential vertical black line defect or no vertical black line defect and a histogram value equal to the sum of all the difference values;

    b.   initially storing the histogram value wherein the cross track sensor pixel address for each cross track sensor pixel relates to each histogram value address;

    c.   performing a vertical black line search by comparing each stored histogram value with a predetermined threshold value to define a defect list of those the cross track sensor pixel addresses corresponding to a vertical black line defect;

    d.   temporarily storing at least two of the first binary image value, the second binary image, and the difference value; and

e.   after the vertical black line search has compared all stored histogram values, outputting image values by comparing each cross track sensor pixel address for the binary image values temporarily stored with each of the cross track pixel sensor addresses in the defect list such that 1) when the compared addresses are not the same the first binary image value is output, or 2) when the compared addresses are equal and the difference value at that particular pixel relates to a potential vertical black line defect the second binary image value is output otherwise the first binary image value is output.